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PATENT SPECIFICATION 1,176,668

DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Hot Water and Cooling Water Plant, particularly for Tire Vulcanization.

We, SVENSKA GUMMIFABRIKS AKTIEBOLAGET, of Gislaved, Sweden, a Swedish Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a hot water and cooling water plant which is intended particularly for tire vulcanization. In such plants great amounts of hot water are required when a new vulcanization cycle is being started, but at the same time the water pressure and temperature must be held within narrow limits. In conventional plants it has been necessary to dimension the components of the plant so that each is capable of handling the maximum demand for hot water imposed by the filling of the vulcanizing press or presses. It would be better to balance the peak loads, so that the system operates with a constant consumption corresponding to the mean hot water demand.

The present invention provides a method for maintaining the pressure in a hot water and cooling water plant intended for a tire vulcanizing press or presses, in which plant the water is to be held at a constant pressure in the presses both during the vulcanization period and the cooling period, the said method comprising applying steam under pressure to a pressurizer communicating with a hot water circulation circuit of the plant thereby to maintain pressure in the hot water circulation circuit, the steam pressure in the pressuriser being transmitted to a cooling water system of the plant thereby to maintain pressure in the cooling water system, supplying heat to the hot water circuit by means of a heat exchanger thereby to heat the water circulating in the circuit, and holding in the pressuriser a volume of hot water sufficient to meet the maximum press filling demand, hot water being withdrawn from the pressuriser and supplied to the hot water circuit as needed to meet the press filling demand.

The invention also provides a pressurized hot water and cooling water plant for a tire vulcanizing plant, comprising a feed water system for the pre-heating and supply of feed water, a system for the supply of cooling water, a hot water system which is connected to receive feed water from the feed water system and comprises a hot water circulation circuit including a heat exchanger and one or more presses, a pressuriser with a constant pressure steam supply connected in parallel to the hot water circulation circuit, whereby the working pressure in the hot water system will depend on the steam pressure in the pressuriser, the pressuriser being arranged and adapted to contain a volume of hot water which can be readily withdrawn into the hot water circuit and is sufficient to meet the maximum press filling demand.

The invention is further described below by way of example in connection with the accompanying drawing which shows plant incorporating the invention, in a schematic way.

The vulcanizing plant shown comprises a feed section with feed and pre-heating tank 1, level control 2, feed pump 3 and lines. The pre-heating is effected by directly supplying low pressure steam at 4. A draining and recovering section comprises a cistern 5, water recirculation pump 6, supply line 7 for clean make-up water, level control means 8 and filtering members 9 at the end of the return line 10 from the vulcanizing press (or presses) 11. A water cooling circuit comprises an indirect cooler 12, circulation pump 13, temperature control means 14, and lines 15

[*Price 5s. 0d.*]

for circulation of water through the vulcanizing press 11.

The hot water system for heating the vulcanizing press 11 comprises a circulation pump 16, indirect heat exchanger 17, pressurizer 18, water lines 19, 20 to and from said pressuriser, by pass line 21 with throttle valve 22, and circulation lines 23.

During the vulcanizing operation hot water of a defined pressure and a definite temperature flows through the press 11 for a certain period. Thereafter follows a cooling operation during which the hot water is circulated *via* the bypass line 21, and the press is cooled by water circulation *via* the lines 15 and the cooler 12.

Steam is used to pressurise the water in the pressurizer 18 because of its greater energy content and its capacity of condensing in the water, whereby its heat is taken up and utilized. The steam is fed through a pipe 40 containing pressure control means 42, 43 to a space above the surface of the water in the pressuriser. The control means 42, 43 keep the steam pressure constant.

The desired pressure and temperature of the hot water do not correspond to saturated steam conditions. The desired pressure, i.e. the steam supply pressure is higher than the saturated steam pressure corresponding to the desired temperature, and the water in the surface layer will assume the temperature of the saturated steam, which is too high for the press. To obtain water at the desired temperature, the following steps are taken:

An outlet pipe coil 24 is placed at such a height in the pressuriser that the volume below said outlet corresponds to the maximum hot water demand of the press, and is connected to the suction side of the circulation pump 16. A pipe 19 is connected to the bottom of the pressurizer and to the hot water feed pipe 23. Consequently the water in the lower part of the pressuriser will circulate through pipes 19, 20 and exchanger 17.

As also water free of oxygen is required, a line 25 conveys water from the delivery side of the circulation pump 16 to the top of the pressuriser, the pressure drop in line 25 corresponding to that in heat exchanger 17, so that the water can reach the top of the pressuriser and be degassed in the pressurizer by means of cascade plates 26. The pressure drop in line 25 can be provided by a controllable valve or a throttle. As this degassing increases the rate of condensation of steam in the surface layer of water in the pressurizer, excess pressure due to insufficient condensing speed is avoided.

The amount of water which in this way is supplied to the top of the pressuriser is very small—about 1% of the total circulation in the plant—and the amount passing through the lower portion of the pressurizer via pipes 19 and 20 is about 3% of the capacity of the circulation pump 16. These rates of flow are adjusted by manually operated valves.

There is a temperature drop across the press 11, and the additional amount of hot water, being small in flow rate, does not disturb the balance in the system because the said amount is supplied to the return side of the plant.

Preheated feed water is supplied when needed from the tank 1 under the control of level sensing equipment 28 which senses the liquid surface in the pressurizer. The equipment 28 is so arranged that the intermittent supply of water through the control valve 29 matches the mean consumption of water.

As the flow of hot water is continuous and heat is stored in the water, the heat exchanger 17 in the pressurizer, the heat exchanger can work under very favourable conditions and need only be large enough to provide the average heat input of the plant; the peak demand imposed by the filling of the press(es) is met by the pressurizer.

The hot water supplied to the press(es) must meet a very high requirement with respect to temperature accuracy. Therefore, a steam flow control valve 30 is controlled in dependence on the temperature in the line 23. To reduce the time constant of the equipment, the temperature sensor 33 is placed in a casing 31 connected to the supply and return lines 23 and provided with manual control valves 32 for adjusting the flow. This arrangement provides quick and direct control of the temperature compared with a conventional installation of thermometers in line 23. A valve 34 is arranged for emptying the casing when the sensing bodies are to be replaced e.g. for service, at which time the valves 32 are closed.

Arrangements must also be made for maintaining a constant flow. During operation, the press is only intermittently traversed by circulating hot water, and the pressure difference between the press inlet and outlet and thereby the flow in the presses varies.

Instead of providing separate control equipment for constant flow, which involves relatively high expenditure, the pneumatic valves 35 normally provided in the apparatus are utilized. The said valves are three-way valves, but they are normally utilized only as two-way valves. By connecting the third ports of the supply and return valves to form a by-pass line and placing in the connection a manual control valve 22 which is adjusted so that its flow resistance equals the flow resistance of the press, the flow in pipes 23 can be kept constant, if when the press is disconnected the hot water is directed through the bypass connection 21 containing valve 22. This bypassing is effected automatically by the programming unit of the apparatus.

For heating the water, low-pressure waste steam is used, as this is an economical source

of heat. The heating takes place in the feed section by directly heating the water at 4 with steam in the feed tank 1. The water is freed from non-condensable gases in tank 1 by passing it over cascade plates 36 in a degasser 37 on the upper surface of the feed tank. The pressurizer 18 has a vent pipe 38 for non-condensable gases. To recover the heat carried by these gases, the vent pipe is connected into tank 1 below the degassing plates 36. On the top of the degasser a throttled vent outlet 39 is provided for venting the gases to atmosphere.

As some of the apparatus in the plant during a period of the vulcanisation cycle needs water of a considerably lower temperature than but of the same static pressure as the hot water, the cooling circuit previously mentioned is provided.

There is no consumption of water in this circuit and the static pressure is maintained by a pipe 27 connected to the water feed pipe downstream of valve 29. Pipe 27 theoretically can be dimensioned merely for the decrease in volume of the water arising from the temperature drop in the cooling circuit. The pressure in the cooling circuit is thereby maintained in relation to that in the hot water circuit and hence the steam pressure in the pressuriser.

The advantages of this plant over a system constructed in a conventional manner with pumps and heat exchangers can be summarized as follows:

In the case of interruption in the power supply, the static pressure in the pressuriser is maintained by the surface layer of hot water which is at boiling point.

Greater accuracy in temperature, because the hot water circuit operates on a continuous, not intermittent, basis.

Greater accuracy in pressure due to the pressuriser.

Flow accuracy due to automatic bypassing of the presses and hence constant water circulation rate.

Constant demand, both for steam and electricity, render better economy in operation.

Utilization of low-pressure steam improves the operational economy.

Due to the fact, that the different components, in particular the heat exchangers and feed pumps, can be dimensioned for the mean instead of the peak demand of the plant, the initial capital cost is lower than in conventional systems, in spite of the provision of the pressuriser.

In the case of interruption in the electric power supply there is greater scope of action and substantially lower production loss.

WHAT WE CLAIM IS:—

1. A method for maintaining the pressure in a hot water and cooling water plant intended for a tire vulcanizing press or presses, in which plant the water is to be held at a constant pressure in the presses both during the vulcanization period and the cooling period, the said method comprising applying steam under pressure to a pressuriser communicating with a hot water circulation circuit of the plant thereby to maintain pressure in the hot water circulation circuit, the steam pressure in the pressuriser being transmitted to a cooling water system of the plant thereby to maintain pressure in the cooling water system, supplying heat to the hot water circuit by means of a heat exchanger thereby to heat the water circulating in the circuit, and holding in the pressuriser a volume of hot water sufficient to meet the maximum press filling demand, hot water being withdrawn from the pressuriser and supplied to the hot water circuit as needed to meet the press filling demand.

2. The method according to claim 1, in which the steam pressure is maintained constant in the pressuriser by pressure control of the supply of steam, and the hot water circulation circuit is supplied with pre-heated feed water of an amount which is controlled to match the mean withdrawal of hot water from the pressuriser.

3. The method according to claim 2 in which a pressure tap communicating with the cooling water system is made from the feed water line downstream of the point at which the supply of feed water to the hot water circuit is controlled, whereby pressure from the hot water circuit and hence the pressuriser is transmitted to the cooling water system.

4. The method according to claim 1, 2 or 3, in which the flow in the hot water circulation circuit depends on the resistance value of the presses, and when a press is disconnected from the circuit the circulation is maintained constant *via* a by-pass line with a flow resistance adjustable to correspond to that of the by-passed press.

5. A pressurised hot water and cooling water plant for a vulcanizing press or presses comprising a feed water system for the pre-heating and supply of feed water, a system for the supply of cooling water, a hot water system which is connected to receive feed water from the feed water system and comprises a hot water circulation circuit including a heat exchanger and one or more presses, a pressuriser with a constant pressure steam supply connected in parallel to the hot water circulation circuit, whereby the working pressure in the hot water system will depend on the steam pressure in the pressuriser, a connection between the hot water system and the cooling water system for transmitting said working pressure to the cooling water system, the pressuriser being arranged and adapted to contain a volume of hot water which can be readily withdrawn into the hot water circuit

and is sufficient to meet the maximum press filling demand.

6. The plant according to claim 5, in which the pressuriser is connected to the hot water circulation circuit *via* a line communicating with the bottom of the pressuriser and a suction device in and spaced above the bottom of the pressuriser, between which device and line the pressuriser contains a hot water volume corresponding to the maximum press filling demand.

7. The plant according to claim 6, in which the pressuriser above the level of the suction device has a hot water space and thereabove a steam space, a level control means being arranged for sensing the position of the hot water surface and for actuating a control means for the feed water supply thereby to maintain the surface at a predetermined level.

8. The plant according to claim 7, in which the said connection is a line connected between the feed water line, at a point downstream of the control means, and the cooling water system.

9. The plant according to claims 5, 6, 7 or 8 in which the hot water circulation circuit is provided with a by-pass line for the or each press and having a flow resistance equal to that of the by-passed press.

10. The plant according to claim 9 in which the or each by-pass line is provided with an adjustable throttle means for setting the flow resistance of the line.

11. The plant according to any of claims 5 to 10 in which the pressuriser has a connection and a control device for the supply of steam of a definite pressure, and the steam space in the pressuriser is connected through a throttled line to the hot water circulation circuit.

12. The plant according to any of claims 5 to 11 in which the heat exchanger is of an indirect type and is provided with means for controlling the supply of heating medium to the heat exchanger in dependence on the temperature in the hot water circulation circuit.

13. The hot water and cooling water plant according to claim 12 in which a sensor for sensing the hot water temperature is arranged in a casing connected to the flow and return lines of the hot water circulation circuit and equipped with adjustable valves for adjusting the flow.

14. A hot water and cooling water plant for a vulcanizing press or presses, substantially as herein described and illustrated in the accompanying drawing.

MARKS & CLERK.

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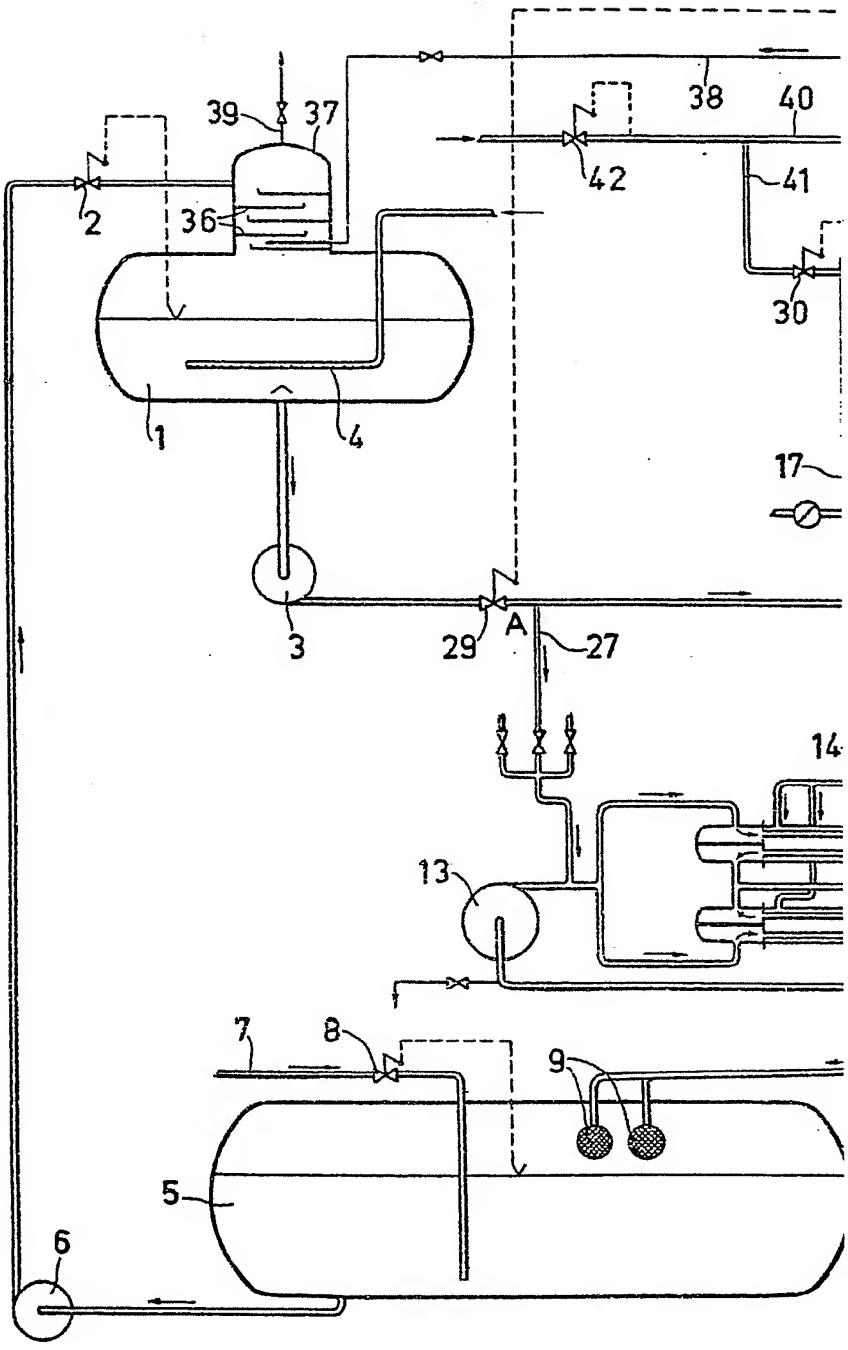
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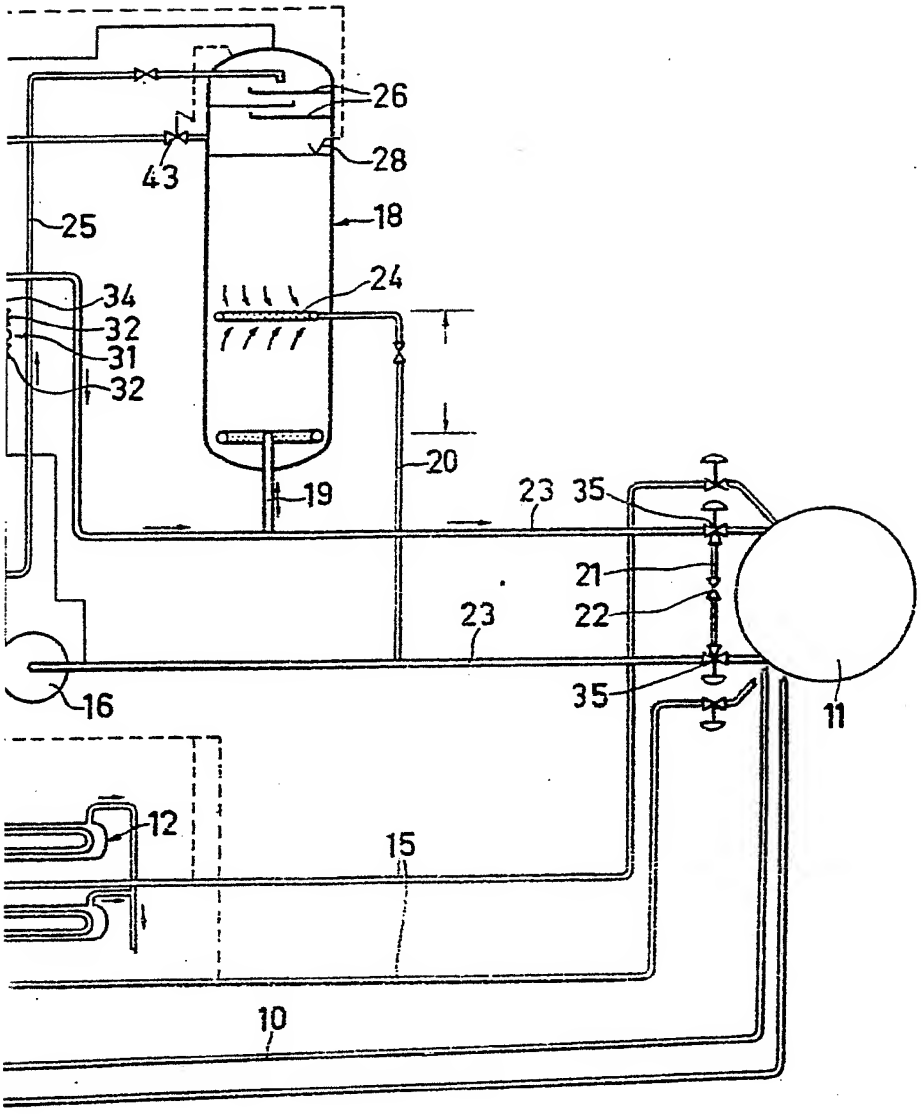

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